

# THE EFFECT OF BLOOD CONTAMINATION OF URINE ON INTERPRETATION OF THE URINARY PROTEIN : CREATININE RATIO IN THE DOG

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## INTRODUCTION

The interpretation of the urinary protein : creatinine ratio (UPC) in urine samples with concurrent haematuria can be confusing, as blood may increase the protein level measured in the urine.

### The objectives of this experiment were:

- To determine if urinary blood contamination affects the UPC level.
- To determine whether urine sample colour can aid interpretation of the UPC in blood contaminated urine.

## MATERIALS AND METHODS

Blood and urine samples were collected from 18 dogs, and a complete blood count and serum biochemistry was performed for each dog.

To mimic haematuria, blood from each dog was added to their own urine sample in twelve increasing levels (from 0 to 5%). On each urine sample the following were performed:

- urinary protein and creatinine,
- dipstick biochemistry analysis,
- specific gravity by refractometry, and
- microscopic sediment examination.

The colour of each urine sample was visually assessed by two observers, and scored from 1-5 corresponding with yellow, peach, orange, orange/red, and red.

## RESULTS

Following blood contamination:

1. The dipstick blood test pad was 4+ for all samples.
2. Adding blood to the urine increased the UPC.
3. The UPC remained <0.5 in all yellow urine samples.
4. The UPC did not increase above 0.5 in any urine sample until it was at least orange.
5. Once the sample was red, the UPC of at least 50% of the samples increased above 0.5.

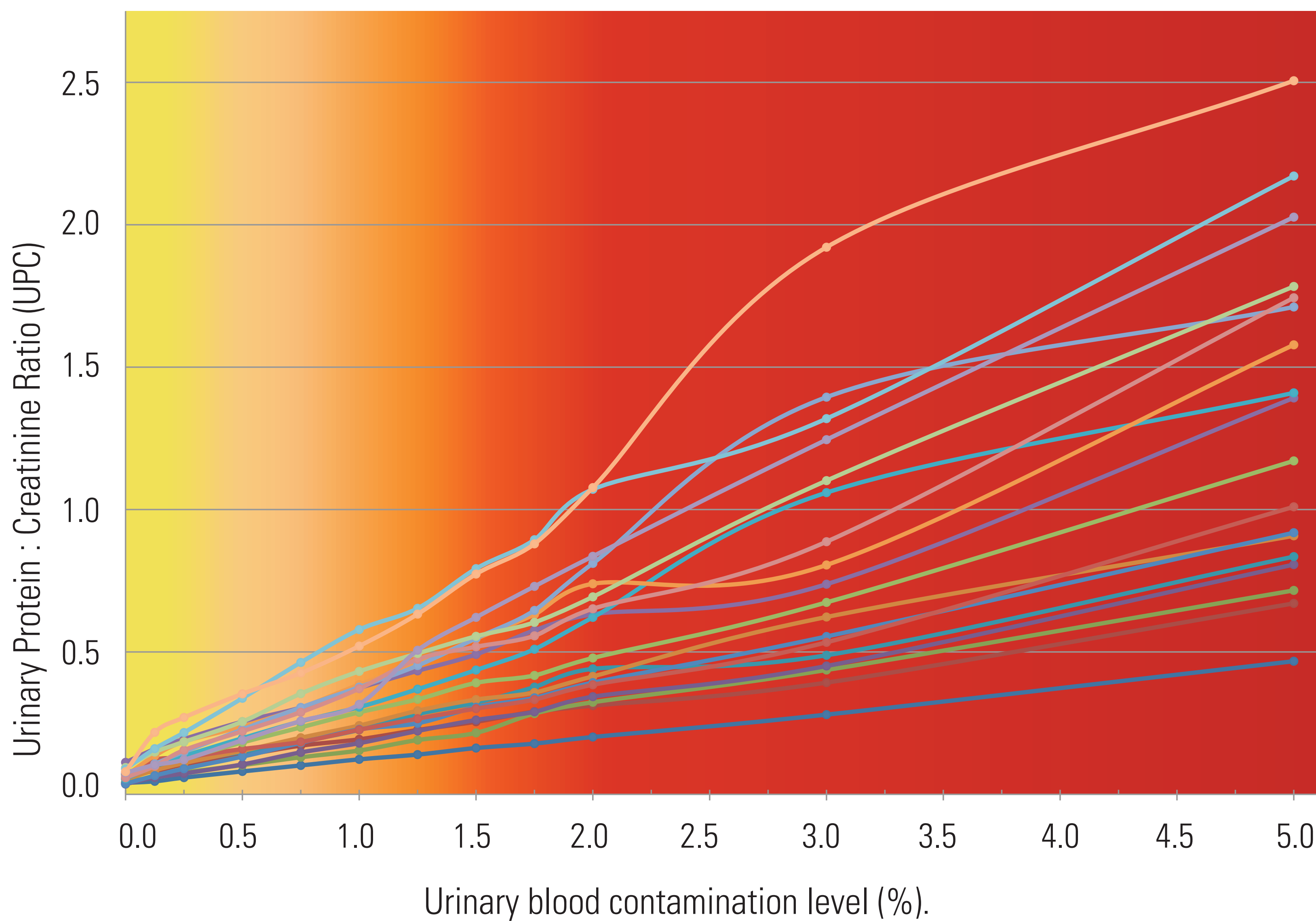


Figure 1. The urinary protein : creatinine ratio (UPC) and colour of urine from 18 dogs with increasing levels of blood contamination. The background colour of the graph correlates to the colour of the blood contaminated urine samples, as denoted by the levels on the x-axis.

Urinary blood contamination level (%)	0.0	0.125	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.0	3.0	5.0
Median Colour Score	1	1	1	1.5	2	3	3	4	4	5	5	5
Number of samples with UPC >0.5 (n=18)	0	0	0	0	0	2	3	7	9	9	13	17
Percentage of samples with UPC >0.5	0.0	0.0	0.0	0.0	0.0	11.1	16.7	38.9	50.0	50.0	72.2	94.4
Blood dipstick	0	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+	4+
Protein dipstick	0	0	1+	1+	2+	3+	3+	4+	4+	4+	4+	4+

Table 1. The median colour score, urinary blood and protein dipstick results, and the number and proportion of samples with a UPC >0.5 for each urinary blood contamination level (%).

## DISCUSSION

The UPC was within reference range (<0.5) in all 18 original urinary samples. When blood was added, the UPC increased in all urine samples.

Knowledge of the urine colour soon after collection appears to aid interpretation of the UPC of blood contaminated urine samples. Blood contamination of the urine that did not result in a visible change in colour of the urine sample from yellow (i.e. microscopic haematuria) did not increase the UPC above the reference range. This is similar to the findings from a previous study of the effect of sample blood contamination (0-0.25%) on urine protein concentrations in a single dog.<sup>1</sup> In the presence of microscopic haematuria, the UPC level in yellow urine (with no evidence of concurrent urinary tract inflammation) should be considered valid.

In the same previous study, the UPC never increased above 0.4.<sup>1</sup> In the present study however, blood contamination causing red urine discolouration increased the UPC above 0.5 in at least 50% of the samples. This difference likely reflects the greater upper levels of urinary blood contamination in the current study.

The blood test pad on the dipstick increased to 4+ in all samples with added blood. This test pad is at least 50 times more sensitive than the protein test pad,<sup>2</sup> making it of limited usefulness for differentiating the level of protein present due to urinary blood contamination.

## CONCLUSION

Blood contamination sufficient to cause red urine discolouration can increase the UPC above 0.5. In this situation, haematuria would need to be considered as a differential diagnosis for the increased UPC.

The UPC level in yellow urine samples with microscopic haematuria, and no evidence of concurrent inflammation, should be considered valid. Rejection of UPC results in animals with only microscopic haematuria appears inappropriate.

## REFERENCES

1. Vaden, SL, Pressler, BM, et al (2004). Effects of urinary tract inflammation and sample blood contamination on urine albumin and total protein concentrations in canine urine samples. Vet Clin Path. 33 (1)
2. Jansen, BS, & Lumsden, JH. (1985). Sensitivity of Routine Tests for Urine Protein to Hemoglobin. Canadian Veterinary Journal. 26 (7)

